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Exploring the Potential of Large Language Models in Supply Chain Management:
A Study Using Big Data

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ABSTRACT

This study aims to identify emerging topics, themes, and potential areas for applying large language models (LLMs) in supply chain management through data triangulation. This study involved the synthesis of 33 published articles and a total of 3421 social media documents, including tweets, posts, expert opinions, and industry reports on utilizing LLMs in supply chain management. By employing BERT models, four core themes were derived: Supply chain optimization, supply chain risk and security management, supply chain knowledge management, and automated contract intelligence, which provides the present status of LLM in the supply chain. The results of this study will empower managers to identify prospective applications and areas for improvement, affording them a comprehensive understanding of the antecedents, decisions, and outcomes detailed in the framework. The insights garnered from this study are highly valuable to both researchers and managers, equipping them to harness the latest advancements in LLM technology and its role within supply chain management.

KEYWORDS

BERT, Large language model, Social Media, Supply chain management

INTRODUCTION

A supply chain, integral to modern businesses, facilitates the exchange of materials, information, and resources among interconnected organizations, ensuring the delivery of valuable products and services to consumers (Stadler, 2008). It operates within a complex web of suppliers, customers, and service providers, which demands intricate decision-making (Bag et al., 2023). While technological

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advancements have automated and optimized supply chain operations, the challenge of conveying optimization outcomes to stakeholders persists.[1]

Furthermore, the exponential growth of Internet data presents both opportunities and challenges for organizations. Modern supply chain professionals must leverage big data analytics, including data science and big data, to enhance the supply chain's processes and performance (Chatterjee et al., 2023; Waller & Fawcett, 2013). However, data quality remains paramount for effective decision-making in supply chain management (SCM), which emphasizes the significance of functional capabilities, information sharing, and data proficiency (Hazen et al., 2014). The successful management of operations and the supply chain hinges on a data-centric approach, which has evolved from traditional reporting to advanced analytics that encompasses statistical analysis, forecasting, and real-time optimization (Jacobs et al., 2014). Nonetheless, integrating big data analytics into supply chains remains a huge scope for research (Kache and Seuring, 2017).

Supply chain operations entail complex decision-making despite the automation and optimization achieved through advancements in computing (Oliveira & Pereira, 2023). Although optimization tools have enhanced the efficiency of supply chain decision-making, they frequently necessitate input from individuals lacking expertise, resulting in prolonged interactions with program managers and data experts (Lambert & Cooper, 2000). The emergence of large language models (LLMs) such as ChatGPT has spurred interest in the application of artificial intelligence (AI) within supply chains. These LLMs, including various deep generative models (DGM), play a pivotal role in deciphering intricate probability distributions (Li et al., 2023a). Within the retail sector, ChatGPT is used to enhance inventory management and detect trends in customer inquiries, seamlessly integrating with supply chain software and warehouse management systems (Kumar et al., 2023). Meanwhile, in the military domain, AI is revolutionizing equipment acquisition and sustainment, predicting demand, optimizing transport routes, and automating inventory management to trim expenses and enhance supply chain efficiency (Mikhailov, 2023).

Another critical aspect of the supply chain involves security breaches. Relying on software systems leads to increased vulnerability to supply chain breaches, resulting in significant financial and data losses. Prioritizing cybersecurity is crucial, yet traditional methods for analyzing past failures involve manual report reading and summarization. Automated support through natural language processing (NLP), including LLMs, can reduce costs and enhance the analysis of such incidents (Trappey et al., 2022; Singla et al., 2023).

There are numerous examples of industries that have started to use NLP and AI to enhance supply chain efficiency. For example, IBM Watson offers SCM solutions that incorporate NLP and AI capabilities. It can analyze unstructured data, such as news articles and social media, to provide insights into supply chain risks and opportunities (Ganesh & Kalpana, 2022). Another firm named SAP Ariba leverages AI and NLP to improve procurement and supplier management. It can assist in supplier discovery, risk assessment, and contract analysis, thereby enhancing supply chain efficiency.[2] Furthermore, Llamasoft's supply chain design software uses AI and machine learning, including NLP, to assist companies in optimizing their supply chain networks. It can process textual data to improve decision-making in its supply chain design.[3] Moreover, GEP SMART is a unified procurement platform that uses AI and NLP to conduct spend analysis, sourcing, and contract management. They can help companies to obtain an enhanced understanding of their supplier contracts and procurement data.[4] Some companies develop in-house or third-party text analysis tools that integrate LLMs, such as GPT-3, to process unstructured textual data from various sources, including news, social media, and email, to extract insights relevant to SCM (Yenduri et al., 2023).

However, the application of LLMs in SCM is still in its infancy, with limited academic literature available on the topic. However, discussions on social media, articles, and blogs have touched upon its potential benefits, particularly in enhancing the effectiveness of SCM (Shrivastav, 2023). For example, effective supply chain talent management is crucial amid disruptions and turnover, with standardization proving challenging due to context-specific operations (Li et al., 2023b). LLMs, trained